Universität Münster

Aktuelle Fragen der Nanophysik

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Tailoring all-optical magnetization for spintronics

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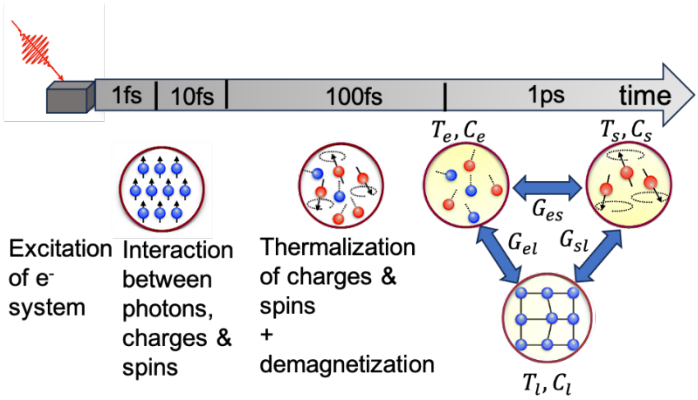
Our understanding of utilizing ultrashort laser pulses to control magnetisation has significantly advanced since Beaurepaire and colleagues discovered the ultrafast response of a spin system to a femtosecond laser pulse[1]. The idea of using light to exploit magnetism, magnetic materials and regulating the magnetic order on ultrashort time scales is becoming vital for their direct applicability for next-generation magnetic devices which combines ultrafast data processing and data storage [2, 3]. This is however a challenge due to lack of understanding of the key parameters controlling magnetism on their fundamental time and length scales. In this presentation, I will talk about the femtosecond laser-activated ultrafast magnetization enhancement observed in FeNi/FePt exchange coupled composite magnets and the exploration of all-optical spin injection in silicon semiconductor [3]. Our investigations utilize time-resolved magneto-optical Kerr effect (tr-MOKE) spectroscopy across the visible and extreme ultraviolet (EUV) spectral ranges, unraveling the underlying phenomenological mechanisms governing these behaviors. EUV Tr-MOKE experiments were performed in a pump-probe mode with the FERMI FEL pulses at MagneDyn beamline, Elettra synchrotron, Italy.



[1] E. Beaurepaire, et al., Phys. Rev. Lett. 76, 4250 (1996).
[2] Lambert, C.-H. et al., Science 345, 1337 (2014).
[3] A. K. Sahoo, et al., J. Magn. Magn. Mater. 563, 169911 (2022).
[4] S. Laterza, et al., Optica, 9 (12) (2022).